45.

a) $\hat{r}(t) = \left\langle \frac{1-t^2}{1+t^2}, \frac{2t}{1+t^2} \right\rangle$ fixed pt attractor $\langle -1, 0 \rangle$

$\hat{v}(t) = \left\langle \frac{(1+t^2)(-2t)-(1-t^2)2t}{(1+t^2)^2}, \frac{(1+t^2)\cdot 2 - 2t(2t)}{(1+t^2)^2} \right\rangle$

$\hat{v}(t) = \left\langle \frac{-2t-2t^3-2t+2t^3}{(1+t^2)^2}, \frac{2+2t^2-4t^2}{(1+t^2)^2} \right\rangle$

$\hat{v}(t) = \left\langle \frac{-4t}{(1+t^2)^2}, \frac{2-2t^2}{(1+t^2)^2} \right\rangle$

b) no. there is no value of t that makes both components 0

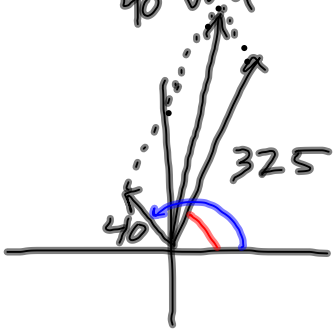
c) $\lim_{t\to\infty} \hat{r}(t) =$

Mar 3-9:00 AM

25.

20° E of N 325 mph $\hat{a}$

40° W of N 40 mph $\hat{w}$



$\hat{a} = \langle 325\cos 70^\circ, 325\sin 70^\circ \rangle$

$+ \quad \hat{w} = \langle 40\cos 130^\circ, 40\sin 130^\circ \rangle$

$\hat{a} + \hat{w} = \hat{g} = \langle \quad \rangle$

$325\angle 70^\circ + 40\angle 130^\circ =$

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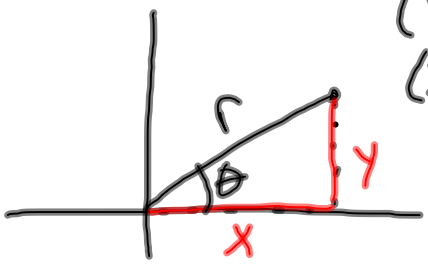
10.3 Polar coordinates, Polar functions



(r,θ)
(x,y)

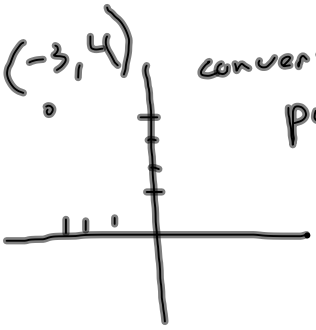
$x = r\cos\theta$

$y = r\sin\theta$

$r = \sqrt{x^2+y^2}$

$\theta = \tan^{-1}\frac{y}{x}$

{add π if the point (x,y) is in QII or QIII}



convert to polar coords

$r = 5$

$\theta = 126.87°$

$= 2.21$ rad

Mar 3-9:48 AM

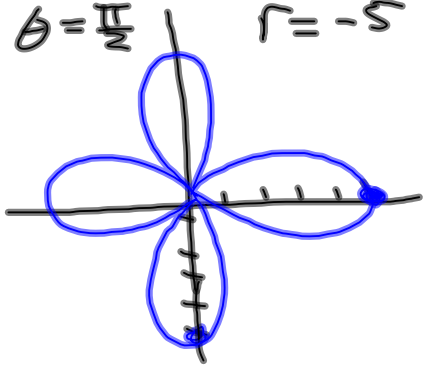
Polar functions

$r = f(\theta)$

$r = 5\cos(2\theta)$

$\theta = 0 \quad r = 5$

$\theta = \frac{\pi}{2} \quad r = -5$



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$$\text{slope} = \frac{dy}{dx} = \frac{dy/d\theta}{dx/d\theta} = \frac{5\cos 2\theta\cos\theta - 10\sin\theta\sin 2\theta}{-5\cos 2\theta\sin\theta - 10\cos\theta\sin 2\theta}$$

$x = r\cos\theta = 5\cos(2\theta)\cos\theta$

$y = r\sin\theta = 5\cos(2\theta)\sin\theta$

$r = 5\cos(2\theta)$

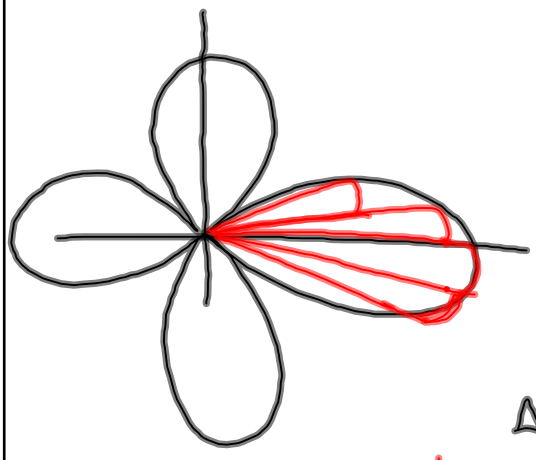
find slope equation

$$\frac{dx}{d\theta} = 5\cos(2\theta)\cdot(-\sin\theta) + \cos\theta\cdot 10(-\sin 2\theta)$$

$$\frac{dy}{d\theta} = 5\cos(2\theta)\cos\theta + \sin\theta\cdot 10(-\sin 2\theta)$$

Mar 3-10:03 AM

area in a polar curve



sector

$$\text{area} = \Delta A = \frac{1}{2}r^2\Delta\theta$$

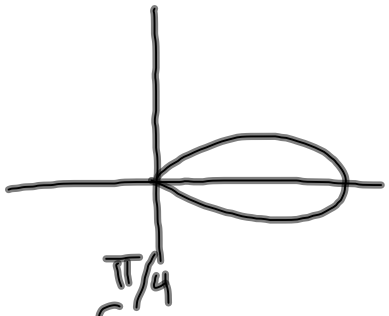
$$\lim_{\Delta\theta\to 0} \sum \frac{1}{2}r_i^2\Delta\theta$$

$$A = \int_{\theta_1}^{\theta_2} \frac{1}{2}r^2\,d\theta$$

Mar 3-10:10 AM

Find the area inside 1 leaf of

$r = 5\cos(2\theta)$



$$\int_{\theta_1}^{\theta_2} \frac{1}{2} r^2 \, d\theta$$

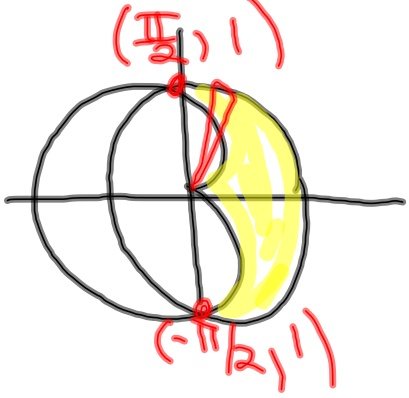
$$\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \frac{1}{2}\left(5\cos(2\theta)\right)^2 d\theta$$

Mar 3-10:14 AM

Find the area inside the cardioid

$r = 2(1+\cos\theta)$ $\quad A = \int_0^{2\pi} \frac{1}{2}\left(2(1+\cos\theta)\right)^2 d\theta$

Find the area inside the circle $r = 1$ and outside the cardioid $r = 1-\cos\theta$



p 554

$$\int \frac{1}{2}R^2 - \frac{1}{2}r^2 \, d\theta$$

$$\frac{1}{2}\int_{-\pi/2}^{\pi/2} 1^2 - (1-\cos\theta)^2 \, d\theta$$

$$= 2 - \frac{\pi}{4} = 1.215$$

Mar 3-10:19 AM